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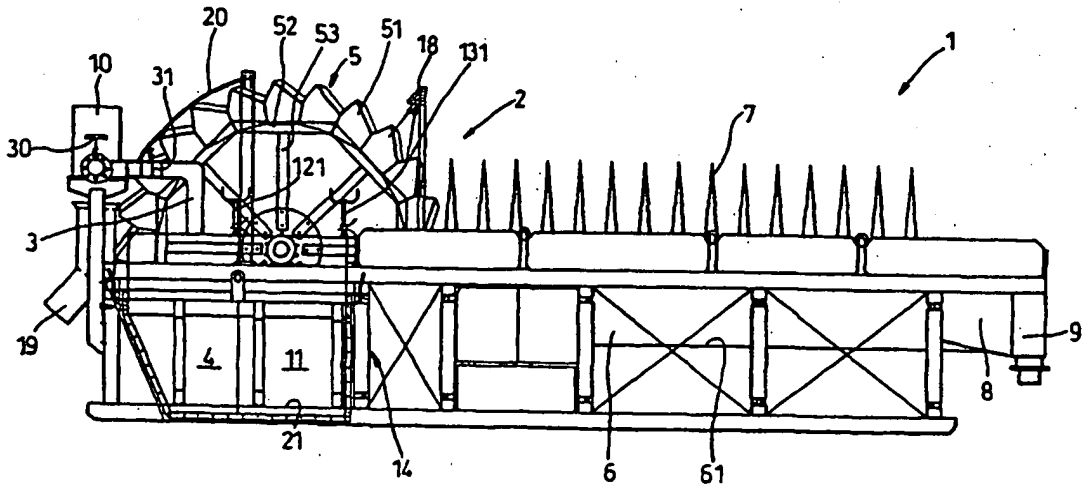
(54) Title: SEPARATION OF SILT AND WATER



(57) Abstract: Apparatus for separating silt from water comprises a settling tank (1) having an inlet section (2) and inlet means comprising an inlet conduit (3) leading to a pre-reaction vessel (4) which communicates at its base with the inlet section of the settling tank. The inlet conduit is supplied with a valve (30), and the apparatus is equipped with dosing means (31) for the addition f flocculate to an inlet portion thereof. Means such as bucket wheels (5) are provided f r removing settled material from the inlet section (2) of the tank (1) and means such as a helical screw (7) are also provided for sweeping settled material along the tank (1) from an utlet section (6) towards that inlet section (2). An outlet is provided for the discharge of water over a weir (8). Apparatus for washing sand r gravel which feeds used wash water to such a settling tank is also disclosed, as are methods f separating silt and water and f washing sand or gravel.

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SEPARATION OF SILT AND WATER

This invention relates to the separation of silt and water. The invention is particularly concerned with the drying of inorganic slurries such as may result from washing of sand and gravel, and in particular the washing of building sand, which results in the washing water bearing a burden of silt.

Freshly won sand or gravel is typically mixed with argillaceous material and this has to be removed from the sand or gravel before that sand or gravel is incorporated into concrete in a building or other civil engineering structure. If the argillaceous material is not removed from the sand or gravel, this severely weakens the concrete with potentially disastrous results. The practice has accordingly arisen of washing the sand or gravel to remove the argillaceous material. Because of its grain size, sand or gravel tends to settle quite quickly in the washing water and can easily be removed and the process results in a body of washing water carrying a burden of argillaceous silt.

It is also known to manufacture sand or other building material by crushing rock, and it is known to wash the crushed material to remove dust. Again, the result is water loaded with fines. Similarly, soil washing operations and certain quarrying applications result in the formation of a slurry.

Hitherto such a slurry has been supplied to settling lagoons where the silt is allowed to settle out over a period of time, whereafter the then silt free water can be discharged from the lagoon to the environment or for re-use.

This settling process takes a considerable period of time and the settling lagoons occupy a substantial area of land. Both of these factors are disadvantages.

It is an object of the present invention to provide a method of and apparatus for settling silt from water in which these disadvantages are alleviated.

According to the present invention there is provided apparatus for separating silt from water which comprises a settling tank having an inlet section, inlet means comprising an inlet conduit leading to a pre-reaction vessel which communicates at its base with the inlet section of the settling tank, said inlet conduit being valved and the apparatus being equipped with dosing means for the addition of flocculant to an inlet portion thereof, removal means for removing settled material from the inlet section of the tank and means for sweeping settled material along the tank from an outlet section thereof towards such inlet section, and an outlet for the discharge of water over weir means.

The invention includes sand or gravel washing apparatus comprising a washing tank, means for supplying said washing tank with sand or gravel and washing water, removal means for removing the settled sand or gravel from an inlet section of the tank and means for sweeping the settled sand or gravel along the tank from an outlet section thereof towards such inlet section, and an outlet for the discharge of silt and water to a settling apparatus for separating silt from water as herein defined.

The invention extends to a method of separating silt from water which comprises passing a silt/water mixture to an inlet section of a settling tank via an inlet conduit leading to a pre-reaction vessel which communicates at its base with the settling tank, dosing the silt/water mixture with a flocculant, removing settled material from the inlet section of the tank, sweeping settled material along the tank from an outlet section towards such inlet section and discharging substantially silt-free water over an outlet weir.

The invention further extends to a method of washing sand or gravel comprising supplying sand or gravel and washing water to a washing tank allowing washed sand or gravel to settle and removing it from an inlet section of the tank, sweeping settled sand or gravel along the tank from an outlet section thereof to the inlet section for removal, passing used, silt containing water from the washing tank and separating the silt from the water by a method as herein defined.

The argillaceous silt which results from the washing of land-won sand or gravel typically has rather small grain sizes, usually of the order of 75 μm down to zero. Because of this small grain size the silt is extremely slow to settle naturally. The use of a method or apparatus according to the present invention greatly speeds up this process and allows a rapid separation of the silt from the water and without occupying a large area of land. The invention is also of value in the removal of water from slurries resulting from the washing of sea-dredged gravel which slurries are largely sand-based, with a low to moderate content of clay.

In preferred embodiments of the invention there is a said inlet conduit and pre-reaction vessel at each side of the settling tank. This promotes the throughput of the apparatus.

Most preferably, said dosing means is arranged to add said flocculant to the or a said inlet conduit. The flocculant and silt/water mixture are thereby encouraged to mix at an early stage in processing and this promotes settling of the silt, even in the pre-reaction vessel(s).

Advantageously the or a said inlet conduit is fed from a header tank. The use of a header tank promotes continuity of feed of material to the inlet conduit and it also acts to stabilise the pressure head with which the silt-

burdened water is fed to the pre-reaction vessel and thus stabilises conditions within the system.

In some preferred embodiments of the invention the or a pre-reaction vessel at at least one side of the settling tank is in fluid flow communication with a secondary pre-reaction vessel over weir means located therebetween, the or each such secondary pre-reaction vessel also being in communication at its base with the settling tank.

We have found that such a system promotes rapid settling. A substantial proportion of settling of the silt takes place in the primary pre-reaction vessel, and water having a lower burden of silt may pass over the weir into the secondary pre-reaction vessel where a further settling can take place.

In such embodiments it is preferred that the or at least one secondary pre-reaction vessel is in fluid flow communication over weir means with a secondary fluid discharge vessel. The water passing into the discharge vessel may be fed to the settling tank or used for other purposes. In some circumstances the water from the fluid discharge vessel may even be clean enough for passing to the environment.

Advantageously the or at least one said weir means bounding a said secondary pre-reaction vessel is adjustable in height. This facilitates control of the system and promotes cleanliness of the water fed to the secondary discharge vessel.

In preferred embodiments of the invention the base of the or each pre-reaction vessel slopes downwardly towards the inlet section of the settling tank. This promotes the flow of settled silt into the inlet section of the settling tank.

Communication between any said pre-reaction vessel and the settling tank is preferably via a submerged throat. The use of such a throat tends to inhibit return flow of silt from the settling tank into the pre-reaction vessel and it stabilises the settled layer of silt particularly when it is wholly submerged in the silt layer. Preferably means is provided for adjusting the size of such throat to control flow therethrough.

Preferably spraying means is provided for spraying the interior of the or a said pre-reaction vessel for clearing accumulated silt. Such spraying conveniently takes place between runs or at the end of a run when the settling tank is substantially empty and the adoption of this feature allows periodical cleaning of that part of the apparatus.

Advantageously also, spraying means is provided for spraying water onto said removal means for clearing accumulated silt.

The removal means may be sprayed at the end of a run or between runs, or it may be sprayed while the apparatus is in operation.

The spraying means is suitably provided with water which has been separated from silt using apparatus according to the invention. Depending on the circumstances, and the cleanliness of the water which is required for such spraying, the water may be taken from the settling tank from the outlet of the settling tank or from a secondary fluid discharge vessel when such is present. Any of these provides a convenient source of spraying water.

In the most preferred embodiments of the invention the inlet section of the settling tank is deeper than its outlet section. This promotes and facilitates separation and removal of the silt from the water.

In preferred embodiments of the invention the outlet section is of part circular cross-section, and the sweeping means comprises a helical sweeping blade, and means for driving such blade in rotation about its axis. This is a particularly simple and convenient way of keeping the base of the outlet section of the settling tank clear of settled material.

Said removal means preferably comprises a bucket wheel. Such is a simple and convenient way of continuously removing settled silt material from the settling tank.

It will be appreciated that settling is a continuous process and that settlement continues while material is held within a bucket of the bucket wheel. In the result, buckets rising from the settling tank will tend to contain a lower layer of settling silt with a relatively clear layer of water above.

It is desirable that as little water as possible should be withdrawn for discharge with the silt and it is accordingly preferred that said bucket wheel includes buckets which comprise leakage ports for the preferential discharge of water and retention of settled material. Thus, water picked up by the buckets can be allowed to leak back into the settling tank and relatively dry silt is removed.

In the most preferred embodiments of the invention, any leakage ports in a said bucket are confined to an upper region of the bucket. Clearly the upper part of the bucket will depend on where it is on the bucket wheel. When speaking of an upper or lower region of a bucket, we denote the upper or lower region of the bucket when it is in the orientation in which it is capable of retaining the maximum amount of fluid. Depending on the shape of the rim of the bucket, this will usually be at about 90° before the bucket reaches the top of the wheel. Advantageously, any leakage ports

in a said bucket are confined to the upper third of the bucket. In this way, surface water which has accumulated in a bucket due to further settling of silt has the opportunity to run off, and by adopting this feature, we have found that little free water remains in the silt by the stage any given bucket has reached the top of the wheel.

In preferred embodiments of the invention the radially outer face of each bucket is provided with side flanges so as together to define a discharge path for the contents of a next successive bucket. This promotes the discharge from the bucket in a desired direction and helps to minimise inadvertent discharge of the silt back into the settling tank.

Advantageously at least one such side flange is perforated for the preferential discharge of water and retention of settled material. This further promotes separation of water from silt.

It is especially suitable to provide one or more run-off strips in a said radially outer bucket face for guiding liquid to those perforation(s) in a flange.

A canopy may be provided over the bucket wheel, at least over a discharge quadrant of the wheel. The canopy may be of a flexible material which will drape to adapt itself to the outer profile of the wheel. The canopy promotes retention of the silt in the buckets of the wheel until just before they reach the discharge position. Without the canopy the silt from a bucket may cascade over the preceding bucket or buckets. The canopy also restrains the silt from falling to either side of the bucket wheel.

Preferably a sleeve is provided in a said pre-reaction vessel which surrounds said inlet conduit at its outlet end, and which, with said inlet

conduit, defines an annular fluid flow passage. The use of such an inlet sleeve has been found to promote settling of the silt from the water.

Such a sleeve is preferably adjustable in height so as to vary its projection beyond the outlet end of the inlet conduit. This provides a valuable control parameter for varying settling conditions to cater for different silt loading in the water supplied to the apparatus and for other variables in the operating system.

A preferred embodiment of the invention will now be described by way of example only and in greater detail with reference to the accompanying diagrammatic drawings in which:

Figure 1 is an elevational view of an inlet end of a silt and water separating apparatus in accordance with the invention;

Figure 2 is a side elevation of the apparatus of Figure 1;

Figure 3 is a plan view showing the inlet and outlet ends of the apparatus of Figure 1;

Figure 4 is a sectional view through silt removing means viewed in a direction which is opposite to that of Figure 2;

Figure 5 is a detailed view of a silt removing bucket; and

Figure 6 shows a weir arrangement.

With reference to Figures 1 to 3 apparatus for separating silt from water in accordance with the invention comprises a settling tank 1 having an inlet section 2 which is fed by inlet means comprising an inlet conduit 3 leading to a pre-reaction vessel 4 which communicates at its base with the

inlet section 2 of the settling tank 1. The inlet conduit is supplied with a valve 30 and it is also equipped with dosing means 31 whereby a flocculant can be added to a silt and water stream flowing in the inlet conduit 3. A means comprising twin bucket wheels 5 is provided for removing settled material from the inlet section 2 of the tank 1. The tank 1 has an outlet section 6 which has a hemispherical base. A helical screw blade 7 works within that hemispherical base 6 to sweep any settled material along from the outlet section of the tank to its inlet section 2. At the outlet end of the tank 1 cleaned water discharges over a weir 8 to a discharge pipe 9.

Broadly similar apparatus but which omits the inlet conduits 3 and side pre-reaction vessels 4 may be used for washing sand or gravel and such apparatus may in accordance with this invention be arranged to discharge silt laden water to the input of a silt and water separating apparatus as shown in the drawings.

As shown, there is an inlet conduit 3 and pre-reaction vessel 4 at each side of the apparatus. A header tank 10 is provided for the initial receipt of silt laden water and for feeding the inlet conduits 3.

At each side of the settling tank 1 the pre-reaction vessel 4 is in communication with a secondary pre-reaction vessel 11. Communication between these two vessels is over a weir 12. Controls 121 are provided for raising and lowering the weir 12. The secondary pre-reaction vessel 11 at each side of the settling tank is in communication with the tank inlet end section 2 in the same way as the primary pre-reaction vessel 4.

The secondary pre-reaction vessel 11 is likewise in contact over a weir 13 with a secondary discharge vessel 14. Weir controls 131 are provided for these secondary weirs.

The weir control means and weirs are shown in greater detail in Figure 6.

As shown particularly in Figure 1 the bases 41, 111 of the pre-reaction vessels 4, 11 slope downwardly towards the inlet section 2 of the settling tank. The side pre-reaction vessels 4, 11 communicate with the inlet section 2 of the settling tank by means of a submerged throat such as that shown at 16 in Figure 1. Means such as a slide plate 161 may be provided for adjusting the size of such throat to control flow therethrough.

Spray heads 17 are provided for spraying the interior of the pre-reaction vessels 4, 11 after they have been emptied in order to clear accumulated silt which is sticking to their walls. Similarly, spray heads 18 are provided for spray cleaning the buckets of the bucket wheel 5.

As shown in Figure 2 the base 21 of the inlet section of the settling tank is at a lower level than the base 61 of the outlet section 6 of the settling tank. This provides a well in which the bucket wheel 5 can operate for the efficient removal of settled silt material from the apparatus.

As shown particularly in Figures 1 and 3 the inlet conduit 3 is provided with a sleeve 32 where it enters the pre-reaction vessel 4. Each sleeve 32 surrounds the outlet end 33 of the inlet conduit 3, and with that inlet conduit, defines an annular passage 34 for fluid flow.

The sleeve 32 is adjustable in height so as to vary its projection beyond the outlet end 33 of the inlet conduit 3.

The screw 7 for sweeping settled silt material towards the inlet end 2 of the settling tank 1 is driven by drive motor 71 shown in Figure 3. The silt swept by the screw 7 enters the deeper inlet section 2 of the settling

tank where it may be picked up by the bucket wheel 5 and transferred to an outlet discharge chute 19. The material discharge from the outlet chute 19 may fall into a vehicle onto a conveyor or direct to ground. A canopy 20 is provided over the bucket wheels 5 in their discharge quadrant in order to restrain semi solid material from falling into the preceding buckets or to either side of the bucket wheels 5. The canopy 20 may be anchored simply at its upper end, and it may be of a flexible material which will drape to adapt itself to the outer profile of the wheel and so assist in retaining the semi-solid silt in the respective buckets until an appropriate time for discharge into the chute 19.

A bucket wheel 5 is shown in greater detail in Figure 4. As may be inferred from Figure 4 the bucket wheel 5 in this particular embodiment consists of eight sub-assemblies each consisting of three buckets 51 assembled to a support bar 52. The support bars 52 are carried at the end of spokes 53 of the bucket wheel 5. A detail of such a three-bucket sub-assembly is shown in Figure 5. As will be seen in Figures 4 and 5 the radially outer face 54 of each bucket 51 is provided with side flanges 55 and these side flanges and the radially outer face 54 of the bucket 51 together serve to define a guide chute which guides collected silt into the discharge chute 19.

At one or both sides of the bucket wheel such side flange 55 is provided with drainage holes 56 through which water may be discharged to fall back into the inlet section 2 of the settling tank. Guide formations 57 are provided on the external radially outward face 54 of the buckets 51 in order to guide water to those holes 56. The guides 57 may take the form of ridges or of channels as desired. Slots 58 are provided in an upper region of each bucket as shown.

Reverting now to Figure 4 it will be seen that as the wheel 5 rotates in a clockwise direction. Silt which has been picked up by the buckets progressively settles leaving a certain amount of water as a surface layer in each bucket. This water may drain out through slots 58 or small holes provided in an upper region of each bucket. We have defined the expression "upper region" as being the upper region of the bucket when it is in the orientation in which it is capable of retaining the maximum amount of fluid. In the Fig. 4 embodiment, there are 24 buckets so they are spaced at 15°. From inspection of that Figure, it will be apparent that this orientation is that of a bucket between 60° and 75° before it reaches it topmost position T.

When the bucket reaches the uppermost position T on the wheel, or shortly thereafter, the water, which is of course less viscous than the silt material, will flow easily over the radially outer face 54 of the immediately preceding bucket and it can be guided by the guides 54 to flow through the holes 56 in the side flanges 55 and thus flow back into the inlet section of the tank. On further rotation, the wet silt contained in the buckets will flow down between the flanges 55 and will eventually fall into the discharge chute 19.

CLAIMS

1. Apparatus for separating silt from water which comprises a settling tank having an inlet section, inlet means comprising an inlet conduit leading to a pre-reaction vessel which communicates at its base with the inlet section of the settling tank, said inlet conduit being valved, and the apparatus being equipped with dosing means for the addition of flocculant to an inlet portion thereof, removal means for removing settled material from the inlet section of the tank and means for sweeping settled material along the tank from an outlet section thereof towards such inlet section, and an outlet for the discharge of water over weir means.

2. Apparatus according to claim 1, wherein there is a said inlet conduit and pre-reaction vessel at each side of the settling tank.

3. Apparatus according to claim 1 or 2, wherein said dosing means is arranged to add said flocculant to the or a said inlet conduit.

4. Apparatus according to any preceding claim, wherein the or a pre-reaction vessel at at least one side of the settling tank is in fluid flow communication with a secondary pre-reaction vessel over weir means located therebetween, the or each such secondary pre-reaction vessel also being in communication at its base with the settling tank

5. Apparatus according to claim 4, wherein the or at least one secondary pre-reaction vessel is in fluid flow communication over weir means with a secondary fluid discharge vessel.

6. Apparatus according to claim 4 or 5, wherein the or at least one said weir means bounding a said secondary pre-reaction vessel is adjustable in height.

7. Apparatus according to any preceding claim, wherein the base of the or each pre-reaction vessel slopes downwardly towards the inlet section of the settling tank.

8. Apparatus according to any preceding claim, wherein communication between any said pre-reaction vessel and said settling tank is via a submerged throat.

9. Apparatus according to any preceding claim, wherein spraying means is provided for spraying the interior of the or a said pre-reaction vessel for clearing accumulated silt.

10. Apparatus according to any preceding claim, wherein spraying means is provided for spraying water onto said removal means for clearing accumulated silt.

11. Apparatus according to claim 9 or 10, wherein said spraying means is provided with water from said settling tank.

12. Apparatus according to any preceding claim, wherein the inlet section of the settling tank is deeper than its outlet section.

13. Apparatus according to any preceding claim, wherein said outlet section is of part-circular cross-section, and the sweeping means comprises a helical sweeping blade, and means for driving such blade in rotation about its axis.

14. Apparatus according to any preceding claim, wherein said removal means comprises a bucket wheel.

15. Apparatus according to claim 14, wherein said bucket wheel includes buckets which comprise leakage paths for the preferential discharge of water and retention of settled material.

16. Apparatus according to claim 15, wherein any leakage ports in a said bucket are confined to an upper region of the bucket.

17. Apparatus according to claim 16, wherein any leakage ports in a said bucket are confined to an upper third of the bucket.

18. Apparatus according to any of claims 14 to 17, wherein the radially outer face of each bucket is provided with side flanges so as together to define a discharge path for the contents of a next successive bucket.

19. Apparatus according to claim 18, wherein at least one such side flange is perforated for the preferential discharge of water and retention of settled material.

20. Apparatus according to claim 19, wherein one or more run-off strips is or are provided in a said radially outer bucket face for guiding liquid to such perforation(s) in a said flange.

21. Apparatus according to any preceding claim, wherein a sleeve is provided in a said pre-reaction vessel which surrounds said inlet conduit at its outlet end and, with said inlet conduit, defines an annular fluid flow passage.

22. Apparatus according to claim 21, wherein said sleeve is adjustable in height to vary its projection beyond the outlet end of the inlet conduit.

23. Sand or gravel washing apparatus comprising a washing tank means

for supplying said washing tank with sand or gravel and washing water, removal means for removing settled sand or gravel from an inlet section of the tank and means for sweeping settled sand or gravel along the tank from an outlet section thereof towards such inlet section, and an outlet for the discharge of silt and water to a settling apparatus according to any preceding claim.

24. A method of separating silt from water which comprises passing a silt/water mixture to an inlet section of a settling tank via an inlet conduit leading to a pre-reaction vessel which communicates at its base with the settling tank, dosing the silt/water mixture with a flocculant, removing settled material from the inlet section of the tank, sweeping settled material along the tank from an outlet section towards such inlet section and discharging substantially silt-free water over an outlet weir.

25. A method of washing sand or gravel comprising supplying sand or gravel and washing water to a washing tank, allowing washed sand or gravel to settle and removing it from an inlet section of the tank, sweeping settled sand or gravel along the tank from an outlet section thereof to the inlet section for removal, passing used, silt-containing water from the washing tank and separating the silt from the water by a method according to claim 24.

26. Apparatus for separating silt from water substantially as herein described with reference to the accompanying drawings.

27. A method of separating silt from water substantially as herein described with reference to the accompanying drawings.

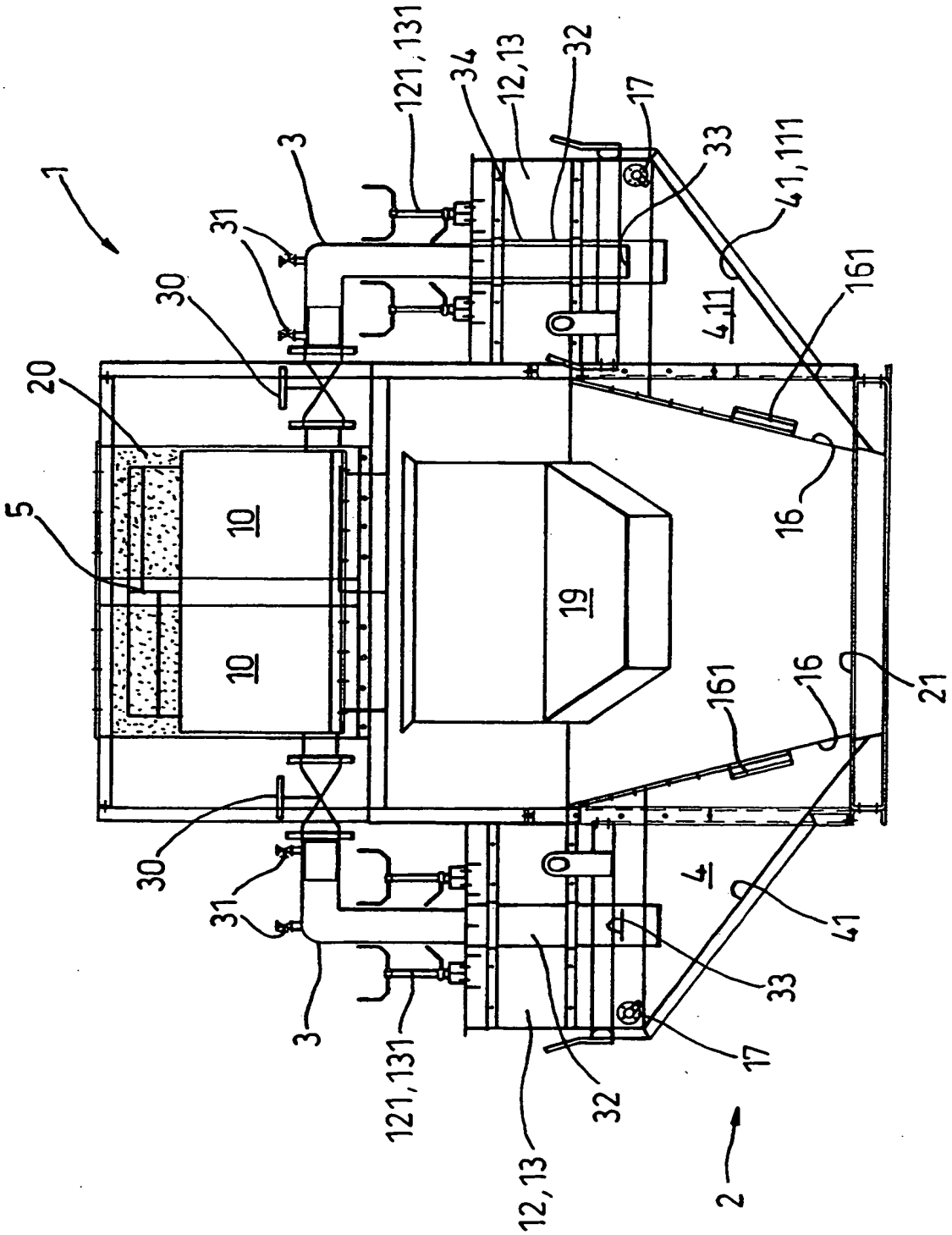
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Fig. 1

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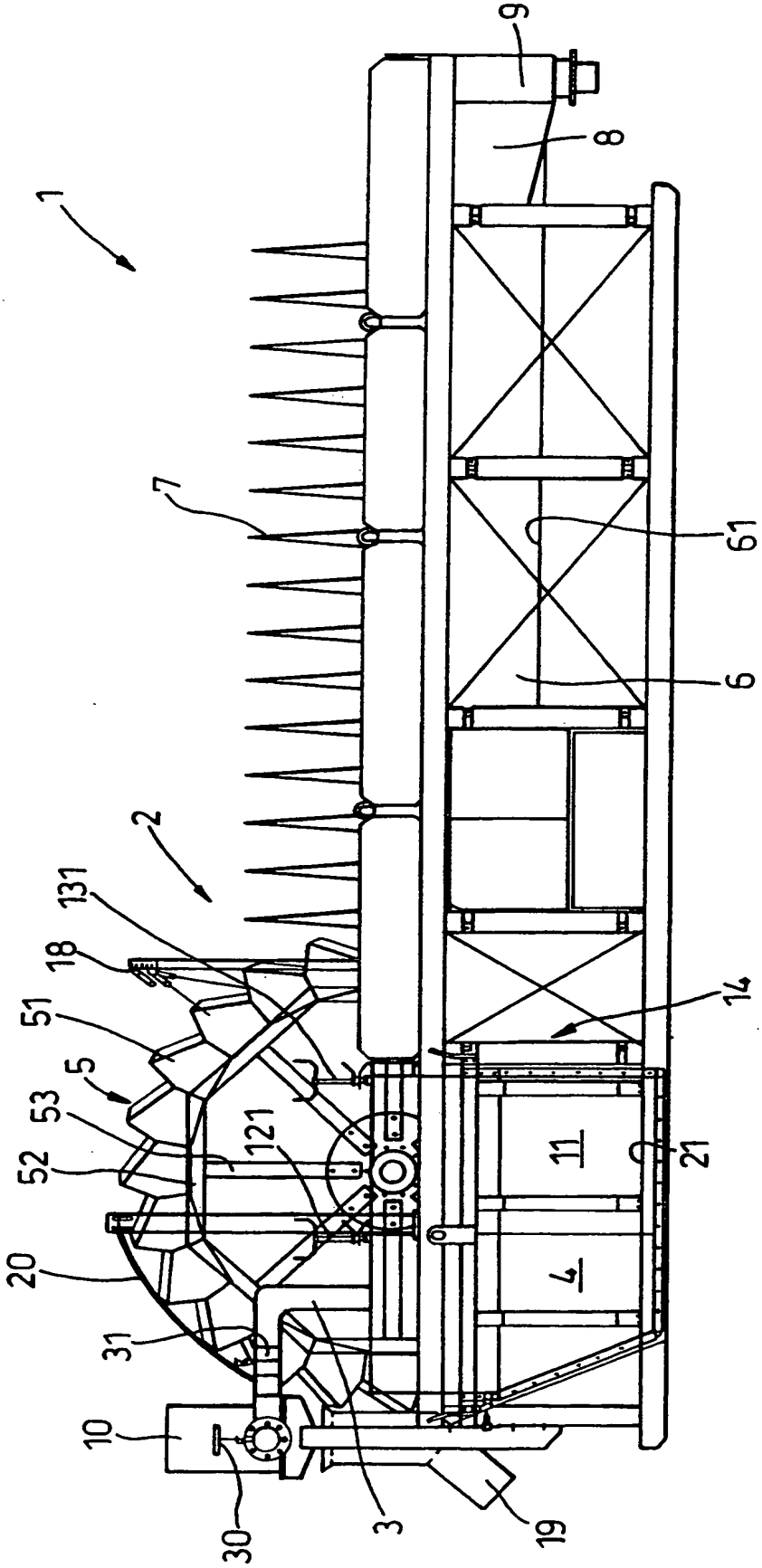

Fig. 2

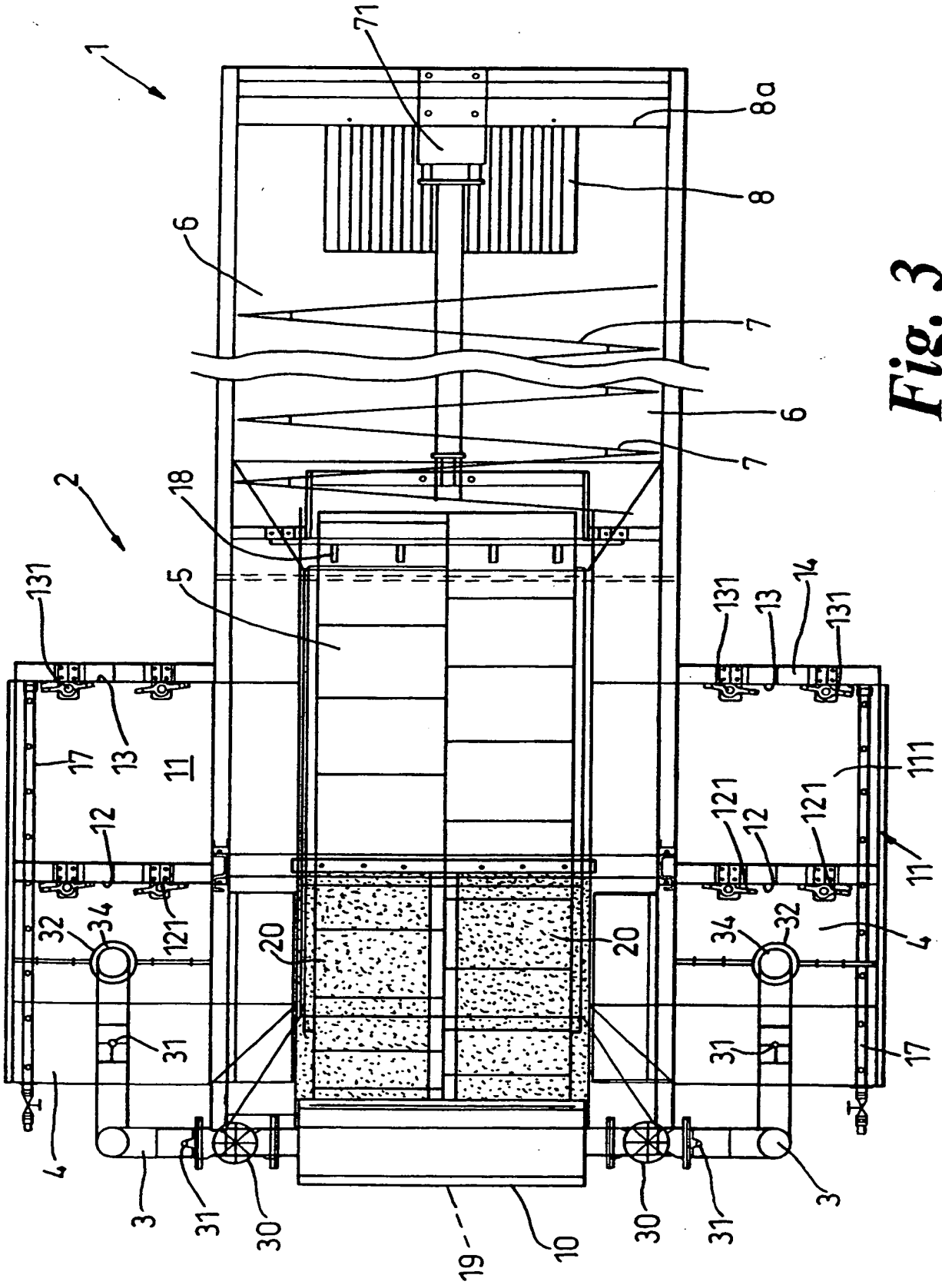
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Fig. 3

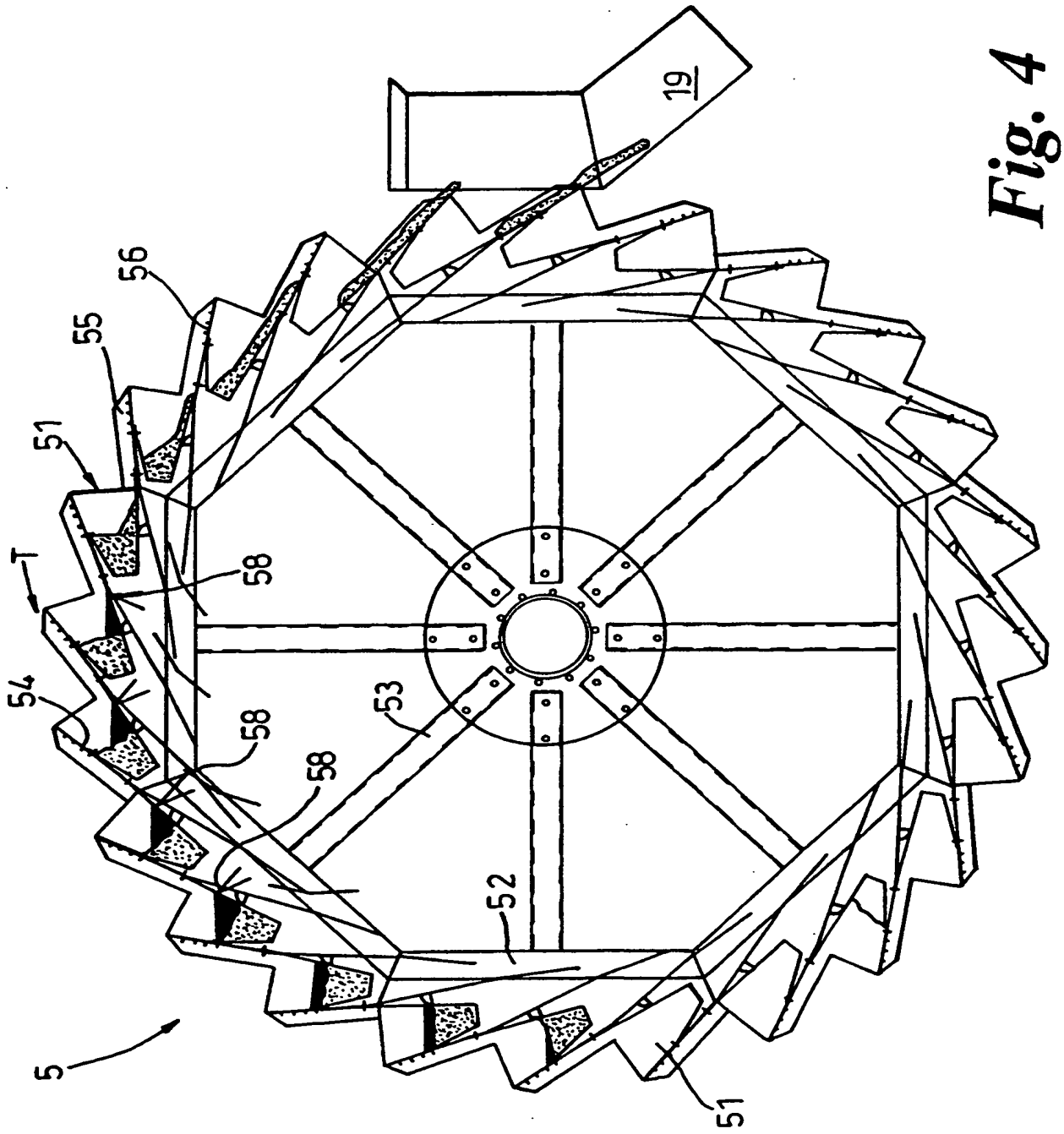

Fig. 4

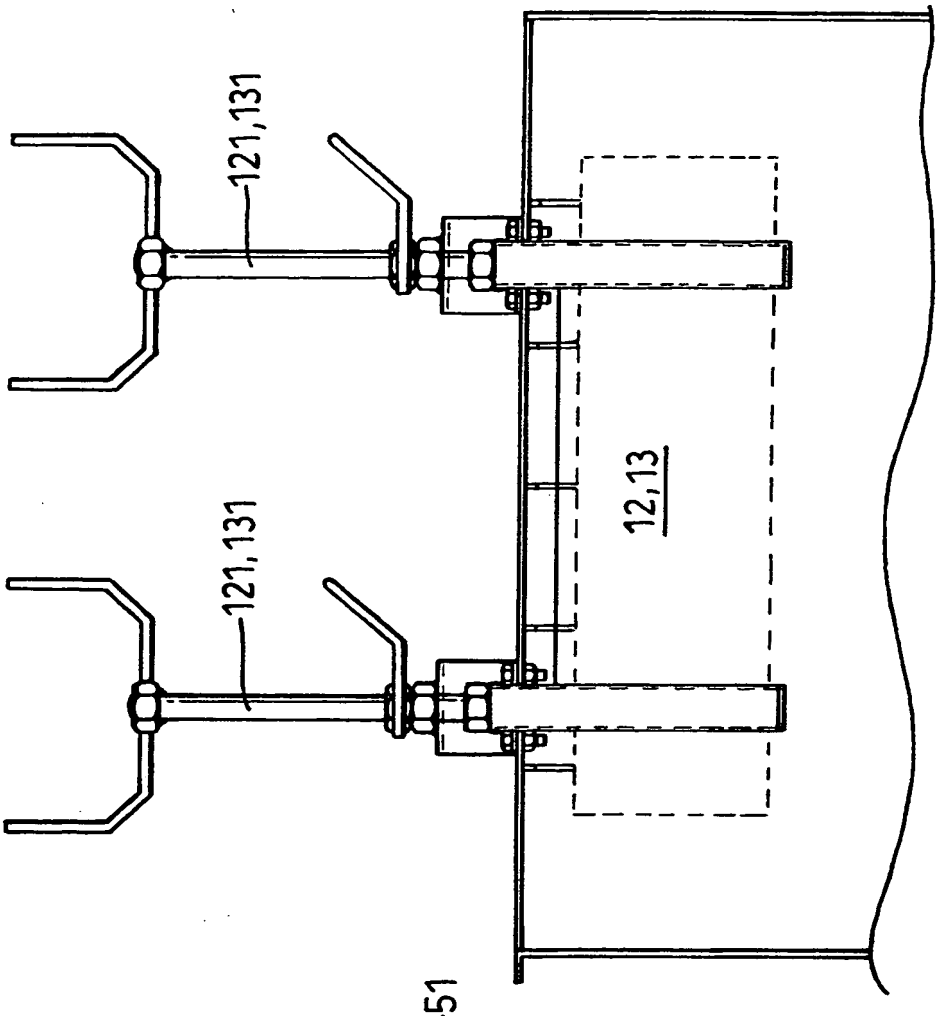
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Fig. 6

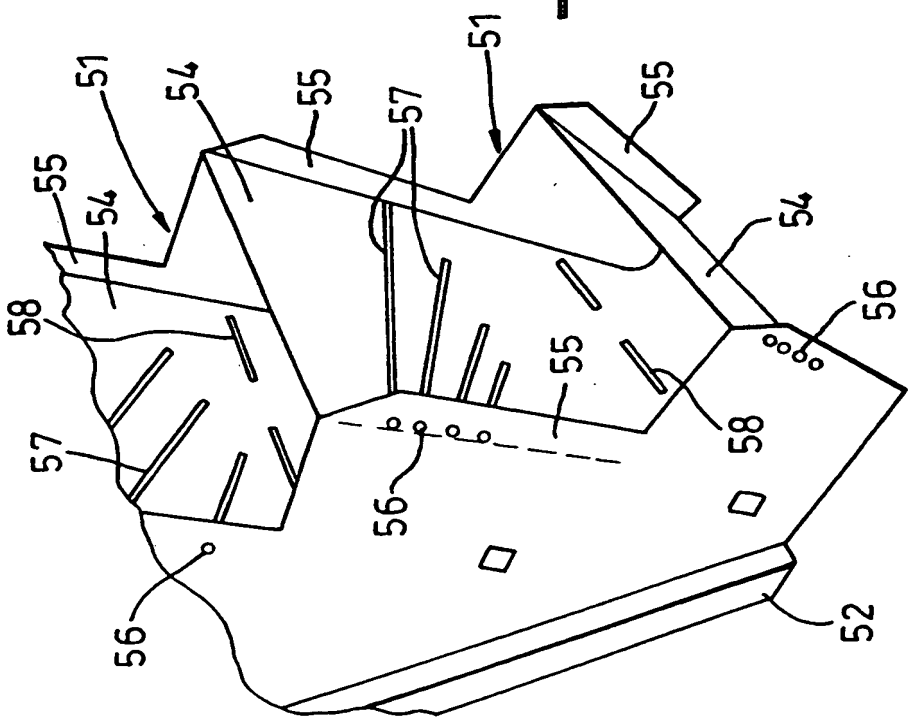
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Fig. 5

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
AHT0210		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 00/ 03827	06/10/2000	09/10/1999
Applicant		
FINLAY HYDRASCREENS (OMAGH) LTD. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

PATENT COOPERATION TREATY

13 FEB 2002
PCT

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
AHT0210		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/03827	06/10/2000	09/10/1999
International Patent Classification (IPC) or national classification and IPC B01D21/06		
Applicant FINLAY HYDRASCREENS (OMAGH) LTD. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
01/05/2001	11.02.2002
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Haderlein, A Telephone No. +49 89 2399 2095

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/03827

I. Basis of the r port

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-12 as originally filed

Claims, No.:

1-27 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2-7,9-12,14,15-22,25
	No:	Claims	1,8,13,23,24,26,27
Inventive step (IS)	Yes:	Claims	none
	No:	Claims	2-7,9-12,14,15-22,25
Industrial applicability (IA)	Yes:	Claims	1-27
	No:	Claims	

2. Citations and explanations
see separate sheet

A. Re Item I **(Basis of the report)**

Independent claim 1 as filed by fax of 29 January 2002 has been amended to include the presence of a sump [21] in the inlet section. In his reply dated 29 January 2002, the Applicant cites claim 12 of the originally filed documents as a the basis for such an amendment. However, there cannot be found any basis for a "sump" neither in that claim nor in the description nor in the figures. In addition, numeral 21 refers to the "base" of the inlet section (see for example p.10, l.13 of the description) and not to a sump of any kind. Originally filed claim 12 only refers to the fact that the inlet section of the settling tank "is deeper" than its outlet section. This does not imply that there is a sump in the inlet section. Therefore, claims 1-25 filed by fax on 29 Jan 2002 do not comply with Art. 34(2)(b) PCT. Consequently, the present report has been drafted on the basis of the originally filed claims (R. 70.2(c) PCT).

B. Re Item V **(Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement)**

B.1 Novelty

i) **D1: US-A-4 710 290** (see Fig. 1) discloses an apparatus [suitable] for separating silt from water which comprises a settling tank (14) having an inlet section, inlet means comprising an inlet conduit leading to a pre-reaction vessel (10) which communicates at its base with the inlet section of the settling tank, said inlet conduit being valved (92), and the apparatus being equipped with dosing means (12) for the addition of flocculant to an inlet portion thereof ("inlet portion" encompassing any area in the vicinity of an inlet of the apparatus), removal means (15 or 75) for removing settled material from the inlet section of the tank ("inlet section" encompassing the space before the baffles 64 in Fig. 19) and means (15 or 75) for sweeping settled material along the tank from an outlet section thereof towards such inlet section, and an outlet (49A) [suitable] for the discharge of water over weir means. Consequently, the subject-matter of claim 1 is not novel over the prior art (Art. 33(2) PCT).

ii) Since D1 relates to the separation of sediment from water (co.1,l.5-12) the independent method claim 24 is also not novel (Art. 33(2) PCT).

iii) The features of claims 8 and 13 are also known in combination from D1. Consequently, their subject-matter is not novel (Art. 33(2) PCT).

iv) The wording of claim 23 is construed as follows : "Sand or gravel washing apparatus comprising..., and an outlet suitable for the discharge of silt and water to a settling apparatus according to any preceding claim". Consequently, the apparatus according to D1 also comprises all the structural and functional features of independent claim 23. Therefore, claim 23 does not fulfill Art. 33(2) PCT.

v) In view of the objection under Art. 6 PCT (see below), claims 26 and 27 are not novel (Art. 33(2) PCT).

B.2 Inventive step

i) The subject-matter of claims 2-7 is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed. Thus, claims 2-7 do not fulfill Art. 33(3) PCT.

ii) With reference to **D2: EP-A-0 785 027** (p.5,l.51-55) it is common practice in the field of sand washing to clear parts of sand washing apparatuses by reusing process water. The subject-matter of claims 9-11 does therefore not seem to involve an inventive step (Art. 33(3) PCT).

iii) The features of claims 12, 14, 15, 18 and 19 are known from **D3: GB-A-2 280 384** (cf. Fig. 1 and p.2,l.1-9) where they have been employed for the same purpose. It would therefore be obvious to the person skilled in the art, to apply these features with corresponding effect to an apparatus according to D1 thereby arriving at the subject-matter according to claims the above claims. Art. 33(3) PCT is not fulfilled.

iv) The features of claims 16, 17 and 20-22 seem to fall within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can be readily contemplated in advance. Consequently, the subject-matter of that claims also appears to lack an inventive step. Art. 33(3) PCT is not complied with.

v) The independent method claim 25 does not involve an inventive step since it differs from the method according to D1 merely in that a sand washing step according to either D2 or D3 is inserted before the silt washing step according to D1. Art. 33(3) PCT is not complied with.

B.3 Industrial Applicability

The possibilities of industrial application arise from throughout the description [Art. 33(1)(3)].

C. Re Item VII (Certain defects in the international application)

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

D. Re Item VIII (Certain observations on the international application)

The wording of claims 26 and 27 contravenes Art. 6 PCT (cf. the PCT Guidelines, III-4.10).

CLAIMS

1. Apparatus for separating silt from water which comprises a settling tank [1] having an inlet section [2], inlet means comprising an inlet conduit [3] leading to a pre-reaction vessel [4] which communicates at its base with a sump [21] in the inlet section of the settling tank [2], said inlet conduit [3] being valved [30], and the apparatus being equipped with dosing means [31] for the addition of flocculant to an inlet portion thereof, removal means [5] for removing settled material from the sump [21] and means [7] for sweeping settled material along the tank [1] from an outlet section [6] thereof towards such sump [21], and an outlet for the discharge of water over weir means [8].

2. Apparatus according to claim 1, wherein there is a said inlet conduit [3] and pre-reaction vessel [4] at each side of the settling tank [1].

3. Apparatus according to claim 1 or 2, wherein said dosing means [31] is arranged to add said flocculant to the or a said inlet conduit [3].

4. Apparatus according to any preceding claim, wherein the or a pre-reaction vessel [4] at at least one side of the settling tank [1] is in fluid flow communication with a secondary pre-reaction vessel [11] over weir means [12] located therebetween, the or each such secondary pre-reaction vessel [11] also being in communication at its base with the sump [21].

5. Apparatus according to claim 4, wherein the or at least one secondary pre-reaction vessel [11] is in fluid flow communication over weir means [13] with a secondary fluid discharge vessel [14].

6. Apparatus according to claim 4 or 5, wherein the or at least one said weir means [12, 13] bounding a said secondary pre-reaction vessel [11] is adjustable in height.

7. Apparatus according to any preceding claim, wherein the base [41, 111] of the or each pre-reaction vessel [4, 11] slopes downwardly towards the inlet section [2] of the settling tank.

8. Apparatus according to any preceding claim, wherein communication between any said pre-reaction vessel and said settling tank is via a submerged throat [16].

9. Apparatus according to any preceding claim, wherein spraying means [17] is provided for spraying the interior of the or a said pre-reaction vessel [4, 11] for clearing accumulated silt.

10. Apparatus according to any preceding claim, wherein spraying means [18] is provided for spraying water onto said removal means [5] for clearing accumulated silt.

11. Apparatus according to claim 9 or 10, wherein said spraying means [18] is provided with water from said settling tank.

12. Apparatus according to any preceding claim, wherein said outlet section [6] is of part-circular cross-section, and the sweeping means comprises a helical sweeping blade [7], and means [71] for driving such blade in rotation about its axis.

13. Apparatus according to any preceding claim, wherein said removal means comprises a bucket wheel [5].

14. Apparatus according to claim 13, wherein said bucket wheel [5] includes buckets [51] which comprise leakage paths [56-58] for the preferential discharge of water and retention of settled material.

15. Apparatus according to claim 14, wherein any leakage ports [58] in a said bucket [51] are confined to an upper region of the bucket.

16. Apparatus according to claim 15, wherein any leakage ports in a said bucket are confined to an upper third of the bucket.

17. Apparatus according to any of claims 13 to 16, wherein the radially outer face [54] of each bucket is provided with side flanges [55] so as together to define a discharge path for the contents of a next successive bucket.

18. Apparatus according to claim 17, wherein at least one such side flange [55] is perforated [56] for the preferential discharge of water and retention of settled material.

19. Apparatus according to claim 18, wherein one or more run-off strips [57] is or are provided in a said radially outer bucket face for guiding liquid to such perforation(s) [56] in a said flange.

20. Apparatus according to any preceding claim, wherein a sleeve [32] is provided in a said pre-reaction vessel which surrounds said inlet conduit [3] at its outlet end and, with said inlet conduit, defines an annular fluid flow passage [34].

21. Apparatus according to claim 20, wherein said sleeve [32] is adjustable in height to vary its projection beyond the outlet end [33] of the inlet conduit.

22. Sand or gravel washing apparatus comprising a washing tank, means for supplying said washing tank with sand or gravel and washing water, removal means for removing settled sand or gravel from an inlet section of the tank and means for sweeping settled sand or gravel along the tank from an outlet section thereof towards such inlet section, and an outlet arranged to discharge silt and water to a settling apparatus according to any preceding claim.

23. A method of washing sand or gravel comprising supplying the sand or gravel and washing water to a washing tank, allowing washed sand or gravel to settle and removing it from an inlet section of the tank, sweeping settled sand or gravel along the tank from an outlet section thereof to the inlet section for removal, passing used, silt-containing water from the washing tank to an inlet section [2] of a settling tank [1] via an inlet conduit [3] leading to a pre-reaction vessel [4] which communicates at its base with the settling tank, dosing the silt/water mixture with a flocculant, removing settled material from the inlet section [2] of the tank, sweeping settled material along the tank from an outlet section [6] towards such inlet section and discharging substantially silt-free water over an outlet weir [8].

24. Apparatus for separating silt from water substantially as herein described with reference to the accompanying drawings.

25. A method of separating silt from water substantially as herein described with reference to the accompanying drawings.

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* AHT0210

Box No. I TITLE OF INVENTION

Separation of Silt and Water

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Finlay Hydrascreens (Omagh) Ltd.
Drumquin Road
Omagh
Co. Tyrone
N. Ireland. BT78 5PN

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: UK

State *(that is, country)* of residence: UK

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

LYONS, David
49 Main Street
Sixmilecross
Co. Tyrone
Northern Ireland

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: UK

State *(that is, country)* of residence: UK

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Barker Brettell
138 Hagley Road
Edgbaston
Birmingham B16 PW
England

Telephone No. 0121 456 1364

Facsimile No. 0121 456 1368

Teleprinter No. 337898

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

NETHERY, John
108 Casltederg Road
Drumquin
Omagh
Co. Tyrone
Northern Ireland

This person is:
- [ ] applicant only
- [x] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: UK

State *(that is, country)* of residence: UK

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [x] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

- [ ] Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **MZ** Mozambique, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **TZ** United Republic of Tanzania, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* . . . . . .

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☒ **AE** United Arab Emirates
☒ **AG** Antigua and Barbuda
☒ **AL** Albania . . . . . .
☒ **AM** Armenia . . . . . .
☒ **AT** Austria . . . . . .
☒ **AU** Australia . . . . . .
☒ **AZ** Azerbaijan
☒ **BA** Bosnia and Herzegovina . . . . . .
☒ **BB** Barbados
☒ **BG** Bulgaria . . . . . .
☒ **BR** Brazil . . . . . .
☒ **BY** Belarus . . . . . .
☒ **BZ** Belize
☒ **CA** Canada
☒ **CH and LI** Switzerland and Liechtenstein
☒ **CN** China . . . . . .
☒ **CR** Costa Rica . . . . . .
☒ **CU** Cuba . . . . . .
☒ **CZ** Czech Republic . . . . . .
☒ **DE** Germany . . . . . .
☒ **DK** Denmark . . . . . .
☒ **DM** Dominica
☒ **DZ** Algeria . . . . . .
☒ **EE** Estonia . . . . . .
☒ **ES** Spain . . . . . .
☒ **FI** Finland . . . . . .
☒ **GB** United Kingdom
☒ **GD** Grenada
☒ **GE** Georgia . . . . . .
☒ **GH** Ghana . . . . . .
☒ **GM** Gambia
☒ **HR** Croatia . . . . . .
☒ **HU** Hungary . . . . . .
☒ **ID** Indonesia
☒ **IL** Israel . . . . . .
☒ **IN** India . . . . . .
☒ **IS** Iceland
☒ **JP** Japan . . . . . .
☒ **KE** Kenya . . . . . .
☒ **KG** Kyrgyzstan . . . . . .
☒ **KP** Democratic People's Republic of Korea . . . . . .
☒ **KR** Republic of Korea . . . . . .
☒ **KZ** Kazakhstan . . . . . .
☒ **LC** Saint Lucia
☒ **LK** Sri Lanka
☒ **LR** Liberia
☒ **LS** Lesotho . . . . . .
☒ **LT** Lithuania
☒ **LU** Luxembourg
☒ **LV** Latvia
☒ **MA** Morocco . . . . . .
☒ **MD** Republic of Moldova . . . . . .
☒ **MG** Madagascar . . . . . .
☒ **MK** The former Yugoslav Republic of Macedonia . . . . . .
☒ **MN** Mongolia
☒ **MW** Malawi . . . . . .
☒ **MX** Mexico . . . . . .
☒ **MZ** Mozambique
☒ **NO** Norway
☒ **NZ** New Zealand . . . . . .
☒ **PL** Poland . . . . . .
☒ **PT** Portugal . . . . . .
☒ **RO** Romania
☒ **RU** Russian Federation . . . . . .
☒ **SD** Sudan
☒ **SE** Sweden
☒ **SG** Singapore
☒ **SI** Slovenia . . . . . .
☒ **SK** Slovakia . . . . . .
☒ **SL** Sierra Leone . . . . . .
☒ **TJ** Tajikistan . . . . . .
☒ **TM** Turkmenistan . . . . . .
☒ **TR** Turkey . . . . . .
☒ **TT** Trinidad and Tobago . . . . . .
☒ **TZ** United Republic of Tanzania
☒ **UA** Ukraine . . . . . .
☒ **UG** Uganda . . . . . .
☒ **US** United States of America . . . . . .
☒ **UZ** Uzbekistan . . . . . .
☒ **VN** Viet Nam . . . . . .
☒ **YU** Yugoslavia . . . . . .
☒ **ZA** South Africa . . . . . .
☒ **ZW** Zimbabwe . . . . . .

Check-box reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ . . . . . .

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 09.10.99	9923853.7	GB		
item (2)				
item (3)				

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): _____

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)* :

ISA /

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	: 4
description (excluding sequence listing part)	: 12
claims	: 4
abstract	: 1
drawings	: 5
sequence listing part of description	:
Total number of sheets	: 26

This international application is **accompanied by** the item(s) marked below:

1. ☐ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☒ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other *(specify)*:

Figure of the drawings which should accompany the abstract: 2

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Barker Brettell

For receiving Office use only

1. Date of actual receipt of the purported international application:
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA /
6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

WO 01/26771
PCT/GB00/03827

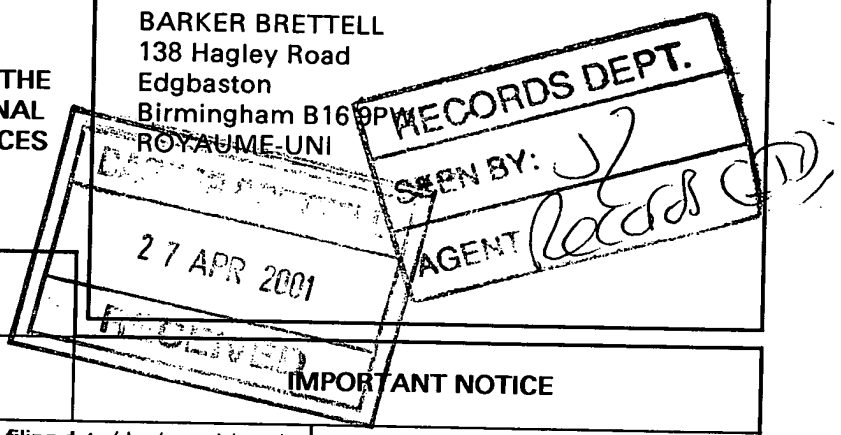
PATENT COOPERATION TREATY

1/21356-WOP

PCT

From the INTERNATIONAL BUREAU

To:
BARKER BRETTELL
138 Hagley Road
Edgbaston
Birmingham B16 9PW
ROYAUME-UNI



NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year) 19 April 2001 (19.04.01)	
Applicant's or agent's file reference AHT0210	**IMPORTANT NOTICE**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/GB00/03827	06 October 2000 (06.10.00)	09 October 1999 (09.10.99)

Applicant
FINLAY HYDRASCREENS (OMAGH) LTD. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,KP,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AE,AG,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CR,CU,CZ,DE,DK,DM,DZ,EA,EE,EP,ES, FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK, MN,MW,MX,MZ,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,
   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   19 April 2001 (19.04.01) under No. WO 01/26771

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, **a demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No. (41-22) 740.14.35

Authorized officer
J. Zahra
Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

INFORMATION CONCERNING ELECTED OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:

BARKER BRETTELL
138 Hagley Road
Edgbaston
Birmingham B16 9PW
ROYAUME-UNI

BARKER BRETTELL
18 JUL 2001
RECEIVED

Date of mailing (day/month/year) 09 July 2001 (09.07.01)	
Applicant's or agent's file reference AHT0210	**IMPORTANT INFORMATION**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/GB00/03827	06 October 2000 (06.10.00)	09 October 1999 (09.10.99)

Applicant
FINLAY HYDRASCREENS (OMAGH) LTD. et al

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

   EP :AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE
   National :AU,BG,CA,CN,CZ,DE,IL,JP,KP,KR,MN,NO,NZ,PL,RO,RU,SE,SK,US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

   AP :GH,GM,KE,LS,MW,MZ,SD,SL,SZ,TZ,UG,ZW
   EA :AM,AZ,BY,KG,KZ,MD,RU,TJ,TM
   OA :BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG
   National :AE,AG,AL,AM,AT,AZ,BA,BB,BR,BY,BZ,CH,CR,CU,DK,DM,DZ,EE,ES,FI,GB,
   GD,GE,GH,GM,HR,HU,ID,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MW,
   MX,MZ,PT,SD,SG,SI,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

3. The applicant is reminded that he must enter the "national phase" **before the expiration of 30 months from the priority date** before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing , if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

   Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

   The entry into the European regional phase is postponed **until 31 months from the priority date** for all States designated for the purposes of obtaining a European patent.

RECEIVING DEPT.
TAKEN BY:
AGENT:

The International Bureau of WIPO
34, chemin des Colombett s
1211 G neva 20, Switz rland
Facsimile No. (41-22) 740.14.35

Authorized officer:
Juan Cruz
Telephone No. (41-22) 338.83.38

REPLACED BY ART 34 AMDT

CLAIMS

1. Apparatus for separating silt from water which comprises a settling tank having an inlet section, inlet means comprising an inlet conduit leading to a pre-reaction vessel which communicates at its base with the inlet section of the settling tank, said inlet conduit being valved, and the apparatus being equipped with dosing means for the addition of flocculant to an inlet portion thereof, removal means for removing settled material from the inlet section of the tank and means for sweeping settled material along the tank from an outlet section thereof towards such inlet section, and an outlet for the discharge of water over weir means.

2. Apparatus according to claim 1, wherein there is a said inlet conduit and pre-reaction vessel at each side of the settling tank.

3. Apparatus according to claim 1 or 2, wherein said dosing means is arranged to add said flocculant to the or a said inlet conduit.

4. Apparatus according to any preceding claim, wherein the or a pre-reaction vessel at at least one side of the settling tank is in fluid flow communication with a secondary pre-reaction vessel over weir means located therebetween, the or each such secondary pre-reaction vessel also being in communication at its base with the settling tank

5. Apparatus according to claim 4, wherein the or at least one secondary pre-reaction vessel is in fluid flow communication over weir means with a secondary fluid discharge vessel.

6. Apparatus according to claim 4 or 5, wherein the or at least one

7. Apparatus according to any preceding claim, wherein the base of the or each pre-reaction vessel slopes downwardly towards the inlet section of the settling tank.

8. Apparatus according to any preceding claim, wherein communication between any said pre-reaction vessel and said settling tank is via a submerged throat.

9. Apparatus according to any preceding claim, wherein spraying means is provided for spraying the interior of the or a said pre-reaction vessel for clearing accumulated silt.

10. Apparatus according to any preceding claim, wherein spraying means is provided for spraying water onto said removal means for clearing accumulated silt.

11. Apparatus according to claim 9 or 10, wherein said spraying means is provided with water from said settling tank.

12. Apparatus according to any preceding claim, wherein the inlet section of the settling tank is deeper than its outlet section.

13. Apparatus according to any preceding claim, wherein said outlet section is of part-circular cross-section, and the sweeping means comprises a helical sweeping blade, and means for driving such blade in rotation about its axis.

14. Apparatus according to any preceding claim, wherein said removal means comprises a bucket wheel.

15. Apparatus according to claim 14, wherein said bucket wheel includes buckets which comprise leakage paths for the preferential discharge of water and retention of settled material.

16. Apparatus according to claim 15, wherein any leakage ports in a said bucket are confined to an upper region of the bucket.

17. Apparatus according to claim 16, wherein any leakage ports in a said bucket are confined to an upper third of the bucket.

18. Apparatus according to any of claims 14 to 17, wherein the radially outer face of each bucket is provided with side flanges so as together to define a discharge path for the contents of a next successive bucket.

19. Apparatus according to claim 18, wherein at least one such side flange is perforated for the preferential discharge of water and retention of settled material.

20. Apparatus according to claim 19, wherein one or more run-off strips is or are provided in a said radially outer bucket face for guiding liquid to such perforation(s) in a said flange.

21. Apparatus according to any preceding claim, wherein a sleeve is provided in a said pre-reaction vessel which surrounds said inlet conduit at its outlet end and, with said inlet conduit, defines an annular fluid flow passage.

22. Apparatus according to claim 21, wherein said sleeve is adjustable in height to vary its projection beyond the outlet end of the inlet conduit.

23. Sand or gravel washing apparatus comprising a washing tank means

for supplying said washing tank with sand or gravel and washing water, removal means for removing settled sand or gravel from an inlet section of the tank and means for sweeping settled sand or gravel along the tank from an outlet section thereof towards such inlet section, and an outlet for the discharge of silt and water to a settling apparatus according to any preceding claim.

24. A method of separating silt from water which comprises passing a silt/water mixture to an inlet section of a settling tank via an inlet conduit leading to a pre-reaction vessel which communicates at its base with the settling tank, dosing the silt/water mixture with a flocculant, removing settled material from the inlet section of the tank, sweeping settled material along the tank from an outlet section towards such inlet section and discharging substantially silt-free water over an outlet weir.

25. A method of washing sand or gravel comprising supplying sand or gravel and washing water to a washing tank, allowing washed sand or gravel to settle and removing it from an inlet section of the tank, sweeping settled sand or gravel along the tank from an outlet section thereof to the inlet section for removal, passing used, silt-containing water from the washing tank and separating the silt from the water by a method according to claim 24.

26. Apparatus for separating silt from water substantially as herein described with reference to the accompanying drawings.

27. A method of separating silt from water substantially as herein described with reference to the accompanying drawings.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/03827

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B01D21/06 B01D21/08 B01D21/24 B03B11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B01D B03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 4 710 290 A (BRILTZ RAYMOND P) 1 December 1987 (1987-12-01) the whole document	1,3,13, 24-27 23,25
Y A	GB 2 280 384 A (BROGAN PATRICK) 1 February 1995 (1995-02-01) the whole document	23,25 1,12-15
X	US 2 110 721 A (FISCHER) 8 March 1938 (1938-03-08) the whole document	24
A	US 2 089 160 A (DARBY) 3 August 1937 (1937-08-03) the whole document	1,6,8,24

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 February 2001	15/02/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	De La Morinerie, B

1

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2 215 185 A (LUND) 17 September 1940 (1940-09-17) the whole document	1,24
A	US 3 962 086 A (ROSSI LIONELLO) 8 June 1976 (1976-06-08) the whole document	1-27
A	EP 0 785 027 A (DRECHSLE ROLAND) 23 July 1997 (1997-07-23) the whole document	1-27
A	DE 296 20 825 U (EGNER ANDREA) 23 January 1997 (1997-01-23) the whole document	1,13, 23-27
A	DE 38 17 948 A (PIEPHO ABWASSERTECH RALF F) 30 November 1989 (1989-11-30) the whole document	1,24
A	GB 2 316 336 A (CLARK MARGARET EASTON) 25 February 1998 (1998-02-25) page 8, line 26 - line 29; figure 1	1
A	DE 37 39 896 A (PIEPHO ABWASSERTECH RALF F) 8 June 1989 (1989-06-08)	

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 00/03827

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4710290 A	01-12-1987	CA 1265267 A	30-01-1990
GB 2280384 A	01-02-1995	NONE	
US 2110721 A	08-03-1938	FR 823869 A GB 502170 A	27-01-1938
US 2089160 A	03-08-1937	NONE	
US 2215185 A	17-09-1940	NONE	
US 3962086 A	08-06-1976	IT 994179 B IT 1050217 B CA 1006121 A DE 2440906 A ES 205296 Y FR 2245457 A GB 1477356 A JP 933923 C JP 50094018 A JP 53011282 B	20-10-1975 10-03-1981 01-03-1977 17-04-1975 01-06-1976 25-04-1975 22-06-1977 30-11-1978 26-07-1975 20-04-1978
EP 0785027 A	23-07-1997	DE 19601481 C AT 197255 T DE 59702547 D	22-05-1997 15-11-2000 07-12-2000
DE 29620825 U	23-01-1997	NONE	
DE 3817948 A	30-11-1989	NONE	
GB 2316336 A	25-02-1998	NONE	
DE 3739896 A	08-06-1989	NONE	

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 09 July 2001 (09.07.01)	
International application No. PCT/GB00/03827	**Applicant's or agent's file reference** AHT0210
International filing date (day/month/year) 06 October 2000 (06.10.00)	**Priority date** (day/month/year) 09 October 1999 (09.10.99)
Applicant LYONS, David et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

01 May 2001 (01.05.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Juan Cruz
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

GB0003827